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Abstract

The aim of this paper is to explain the connection between firm size and business strategy, one of the more important links between market structure and market behavior.

The theory given in the paper predicts a set of propositions: (a) the larger a firm's custom, the greater the propensity to choose additional advertising in preference to a price cut; (b) the larger the custom, the greater the propensity to raise price rather than increase or decrease advertising or cut price; (c) the larger the custom, the greater the propensity to reduce quality rather than increase advertising or cut price; and (d) the larger the custom, the less the propensity to develop cost-increasing quality improvements rather than lower price or increase advertising.

The fundament of the theory is that the large the custom, *ceteris paribus*, the large the number of "attached" customers who will pay less (more) if price is decreased (increased), and whose revenue could otherwise be counted on at the old price. Advertising does not affect revenue from the "attached" customers. Quality changes are similar in nature to price changes in this context. And the relationship of R&D activities to custom depends upon the type of discovery that is sought.

FIRM SIZE AND MARKET BEHAVIOR:
A THEORY OF THEIR RELATIONSHIP

Julian L. Simon*

I. INTRODUCTION

The aim of this paper is to throw light on how and why firms differ in their choices among price, advertising, product quality, and R&D as competitive variables.

This topic has two roots. A theoretical root is the observation that there is a fundamental difference between two classes of competitive variables. While obtaining more customers, some competitive variables do not affect the revenue gained from existing customers, whereas other variables do affect the amount received from customers who would buy anyway.

An empirical root is the bewildering array of devices such as cents-off coupons, lotteries, special promotions, special services, and so on that we observe firms using. Why does one firm use one sort of device at one time, whereas another firm uses another?

It is all-important to keep in mind which firms the paper is about, and which it is not about. The context of the analysis includes Crain Publishing's magazine Advertising Age, a fast-food chain such as Pizza

*I appreciate helpful criticism by Walter Primeaux, Edward Rice, and James Smith. I enjoyed the opportunity of presenting the paper at the Marketing and Industrial Organization Workshops at the University of Illinois, and the Industrial Organization Workshop at the University of Chicago.

Hut, a seller of art books such as Harry Abrams, Inc., L. L. Bean's sporting goods offerings, semi-conductor manufacturers, Kawasaki motorcycles, Ozark Airlines' route from Champaign-Urbana to Chicago, and a university extension course on "Corporate Planning with a Marketing Focus." None of these goods is sold in a narrowly-defined market with a homogeneous physical product, such as the beer industry or the builder's sand industry. And the commonly-used concepts of market and market share are hard to define meaningfully for such firms. Therefore, in place of market share, this paper works with a firm's "custom", the number of customers at any one moment who have some loyalty to the firm from the previous period to the upcoming period. And, in place of the market concept, the paper uses "market potential", meaning the number of additional customers the firm could expect to have with varying combinations of price and other variables. More specific definitions follow later.

Firms in narrowly-defined markets, for whom the notion of market share is more appropriate, are more difficult to think clearly about in this connection because of the conscious interactions among them. But it is not unlikely that the ideas developed here for the non-interactive firm can later be extended to firms in narrowly-defined markets, too.

To avoid disappointment and confusion, it should be understood what the paper will not aim to do. It will not relate the firm's choices among competitive variables to general equilibrium analysis, or even to market equilibrium. Instead, the context is like that of "Austrian" disequilibrium, which views a market as in constant ferment due to a variety of disturbances from outside the market, together with necessarily

imperfect attempts by entrepreneurs to take advantage of the profit opportunities that exist as a result of the disturbances outside plus the changes made by other firms trying to exploit opportunities for profit. (For discussion of the Austrian viewpoint on this matter, see Hayek, 1949, Chapter 5, or Kirzner, 1973, Chapter 1.)

In consonance with this view of the market, firms differ in size, the size (custom) of the firm being taken to be exogenous in this context. A similar view of firm size is expressed, justified, and used, by other well-accepted writers in very different contexts. For H. Simon (in the work for which the Nobel was ostensibly given him, I believe) size of firm results from ^{the} growth process simply taken as random without further discussion. For Arrow, the cause is differences in information costs among firms.

the combination of uncertainty, indivisibility, and capital intensity associated with information channels and their use imply (a) that the actual structure and behavior of an organization may depend heavily upon random events, in other words on history. (1974, p. 49)

For Hayek, the congeries of fact^s about competition (as he defines competition) necessarily lead to differences in size.

That in condition of real life the position even of any two producers is hardly ever the same is due to fact which the theory of perfect competition eliminates by its concentration on a long-term equilibrium which in an ever changing world can never be reached. At any given moment the equipment of a particular firm is always largely determined by historical accident. (1949, p. 101)

Whatever explanation or non-explanation one prefers of the differences in firm size assumed here, this assumption accords with the observed fact that firms differ in size in any given industry. The context is not a long-run general equilibrium where all differences have been ground down

and all firms rendered homogenous in such fashion that it seems appropriate to conduct the analysis in terms of a single "representative" firm whose central characteristics all firms share. Rather, in the context of this paper, the differences among the firm are central. This plainly is not consistent with the spirit of market-equilibrium analysis, at least as developed until now. And since reality plainly shows variation in firms to be an important fact, market-equilibrium analysis simply must be set aside for now when thinking about the issues analyzed here. In short, either the question raised by the paper must be considered unimportant, or the analysis must be found to be logically inconsistent, or the demands of market equilibrium analysis ought to be disregarded here.

The examples of firms mentioned earlier, and perhaps especially the turbulent airline industry in the late 1970's and early 1980's, may serve to fix in the mind the aspect of economic reality that the paper aims to help understand. The price cuts and increases, the changes in services given, and the shifts in airline routes following on deregulation, increases in gasoline prices, and the air controllers' strike and firing, exemplify a situation in which the notion of market equilibrium seems particularly inappropriate, and such an example offers particular justification for conducting the analysis without the notion of market equilibrium, as is done here.

There is no suggestion here that the equilibrium approach of standard economics is unsound or wrong. Different approaches with different assumptions and different points of view are useful for different purposes. By analogy, it is useful for a variety of scientific and practical purposes, to assume that the sea is level, or that it tends toward being level, but

not when one wants to understand wave motion. And if one simply assumes that the sea is level, then one will not even try to understand what makes some waves behave in the various ways in which they behave. In some economic inquiries--those that focus on the response of market and perhaps of the economy to shocks, and therefore need not attend to differences among firms--it is appropriate to study the levels at which price and quantity and perhaps other variables will eventually settle down. For the purpose at hand, however--which is to understand the strategic competitive choices made by firms that differ in their characteristics--market equilibrium before or after the choice need not enter the analysis. It may be that eventually one might be able to wed the approach offered here with a context of market equilibrium. Or on the other hand, it may be (as I think the Austrians would argue) that even to introduce the notion of market equilibrium here would deflect the reader's attention from key aspects of the question that this paper seeks to understand. Either way, I very much hope that you will not judge this effort by the criteria appropriate to a study that inquires into market equilibrium, or expect the use of analytic tools appropriate in that context. The tool used here is different, and I hope that its novelty and its simplicity will be seen as strengths rather than as an indication of incapacity to use the standard tools. Even if the argument can be restated using the standard tools without loss of intended meaning (about which I have doubts) the fair test would seem to be whether the argument is put forth in sufficiently precise form to be unambiguous, rather than whether the form is that considered elegant in contemporary economic culture. I hope the method offered here is seen as a new intellectual technology rather than as an inferior form

of the standard technology. If the paper is successful in helping understand for some firms this aspect of economic behavior that is not now understood, it should be sufficient justification for the paper even if the approach does not fit with the standard canon of equilibrium price theory.*

*I hope the reader will forgive me for going on at such length in this fashion. But acceptance of the conventional equilibrium framework as necessary for dealing with this question prevents acceptance of the . . . approach. Consider, for example, one editor's rejection letter:

I have read your paper and unfortunately agree with the reviewer that the paper is not suitable for publication without extensive revisions. I didn't understand how M could be taken as exogenous in your model. What is disturbing the system each period to prevent it settling into a long run equilibrium? What is the stochastic equilibrium if firms initially differ in M? Do the firms converge to a uniform policy? In short, as the referee states, the dynamics must be more carefully worked out.

(Dennis W. Carlton, Editor of The Journal of Law and Economics, correspondence, September 28, 1981).

Another example is the referee's report ^{from} ~~in~~ the Journal of Political Economy:

This paper consists of a contrived two period model of the world. Accordingly, it fails to consider the effect on the steady-state solution of either price changes or advertising. The work also ignores the economic determinants of size of firm and seems to assume that the distribution of firms by size is a random event that is unrelated to price and product quality. In a simple price quality model with competitively determined full prices any two but not all three of the following are determined by the firm; size of firm, price, and quality. In the context of this general model the comparisons made by the author do not make sense. What must be accomplished is an industry equilibrium model with adjustment costs and a steady state solution. Then perhaps the author's results may indicate the difference between short-run market behavior and long-run behavior. Lastly, the theoretical evidence all suggests that monopoly and competition produce the same product quality. The author's results contradict this conclusion with no formal proof.

In addition to being an early attempt to shed light on a particular aspect of economic behavior, it may be that the paper's formal method can assist Austrians in communicating some of the ideas that they ordinarily write about using verbal logic only, and that may therefore enhance their attempts to argue their point of view. The aim of this paper is, however, different than the central aim of the Austrians, if I understand them correctly. Whereas they wish to emphasize the fluidity and the indeterminate quality of the markets within which entrepreneurs operate, I wish to analyze in a determinate fashion the choices that particular firms make under particular conditions which differ from firm to firm. That is, what is noise for the Austrians is data for this paper. But to show that the outcomes differ determinately when conditions differ, which then leads to changes in the market, which then alters the conditions of other firms and then of the firm under analysis as well, should fit comfortably with the Austrians' vision of the economy.

The sequence of events mentioned just above, beginning with a change in a firm's situation and proceeding through its competitive decision to a change in the market environment for other firms, then to choices of tactics by other firms and changes in their characteristics, and finally influencing the condition of the firm in question, should also make clear how difficult it would be to construct a satisfying picture of market equilibrium that would serve as illuminating context for issues at hand. Such an equilibrium would require solution of multi-firm oligopolistic competition in a determinate fashion, and there is theoretical reason to believe (Simon, Puig and Aschoff, 1973) that such a one-pointed

determinate solution is not realistic for even two-firm duopoly, let alone more than two firms, unless more conditions are specified that are imaginable in any market analysis. But once again, this by no means implies a criticism of the concept of market equilibrium for other analytic purposes, any more than thinking of light as a particle suggests that thinking of light as a wave is always inappropriate, or vice versa.

The analysis offered here picks up the process of doing business at the point where relevant information has been collected and assimilated. But this is not intended to minimize the importance of the scanning process which such writers as Kirzner (1973, p. 35) refer to as "entrepreneurship".

The firm's choice of competitive variables is known as the firm's "strategy" to students of marketing, who routinely adduce the "character" of the firm in addition to the state of the market and competition when explaining the strategic behavior of firms. Economists have tended to look outside the firm at the characteristics of the market and the number of competitors, but in recent years this has been changing. For example, a recent study of product innovation and other competitive strategies in the semiconductor industry (Wilson, Ashton, and Egan, 1980) traces the causal links empirically from a number of characteristics of the firm (including capital availability, level of R&D spending, degree of risk taking, and the nature of top management and its organizational control, p. 37); to the firm's choice of strategies among product design, reliability, pricing, and breadth of product lines (pp. 78-79); to the financial and social performance of the firm and the industry. But there has been absent a

theoretical basis for predicting which strategies would be adopted by firms of different types, which is the lacuna this paper tries to enter.

This paper suggests that the nature of the firm is indeed important, and should not be ignored. But many important relevant characteristics of the firm are understandable in terms of standard economic concepts, especially lagged responses to price and advertising; sunk costs of equipment, information, and advertising; and the levels of fixed and variable costs. The most salient of these concepts for the subject of market structure and behavior are the twin ideas of sunkness of costs, and lagged consumer responses. These same concepts can also give us a more fundamental understanding of the phenomena usually explained by "barriers to entry," but that discussion will be pursued elsewhere.

The paper begins with, and concentrates on, the choice between a price cut and increased advertising as competitive variables in relationship to the firm's size. It also suggests how a similar type of analysis can explain which among competing firms will cut prices and quality, and which will raise them; R&D behavior; and product "positioning" a la Hotelling.

As it stands, the argument is purely theoretical, though some bits of evidence bolster it in a few places. The aim--as I believe should usually be the aim of theoretical pieces--is to make a plausible case that the propositions drawn from the theory deserve empirical testing. I do not offer the argument as ironclad proof that the conclusions hold, of course; no theoretical piece can ever do that, because theory must always simplify from reality in a variety of ways.

If the argument is not found to be internally inconsistent, and the assumptions do not depart too greatly from reality, perhaps the reader will be satisfied that the propositions are of some interest until they are disproven empirically.

II. ADVERTISING VERSUS PRICE

Consider two firms operating in similar market conditions but in situations where we can ignore interaction between them. Why does one of them cut price and another increase its advertising? The psychologist may attribute the differences to the personalities or the ethnic backgrounds of the managers, and marketing men put it down to some "characteristic strategy" of the firm, which may come down to being another label for the competitive choices the firm habitually makes. But neither of these sets of explanations has been very satisfying to economists.

Many writers (e.g., Stigler, 1968; Simon, 1970) have noticed a fundamental difference between advertising and price as competitive variables: Advertising to get more customers has no negative effect upon the firms' existing customers, and perhaps has a positive effect upon them, whereas a price-cut to increase market share reduces revenue from the firm's existing customers. But the implications of this difference for understanding a firm's behavior in terms of the firm's present situation seem to have been overlooked. The paper shows that it follows from this difference that the larger is the firm's present custom, *ceteris paribus*, the greater is its propensity to use advertising and the less its propensity to use price cuts. This analysis bears a relationship to Adam's analysis (1977) of advertising as a device which permits the firm to discriminate--

that is, to treat each customer or class of customers differently--whereas ordinary commercial pricing of many goods does not permit such discrimination.

One can quickly prove that when price is considered in isolation, the smaller firm has a greater propensity to cut price than the larger firm. But the same can be shown for advertising considered in isolation. The question is: why is the price cut relatively more attractive than advertising when the firm is relatively smaller?*

Proof That the Firm With the Larger Custom Will Prefer Increased Advertising to Price Cutting

The aim of this section is to prove the following proposition:

Proposition 1: A firm having a larger custom will have a greater propensity to increase advertising than to cut price, whereas a firm with a smaller custom will prefer a price cut.

Now some more specific definitions: By "custom" (M) is meant the number of persons who bought from the firm in period $t-1$ and who will also buy from the firm in period t if there is no increase in price, even if the firm does no advertising (all other promotional activity being ignored for the time being). In the example below, the attachment force that underlies market share will be a contract, which binds the person for certain. More realistic forces include customer inertia,

*A related but more general question is: Why does a firm with a smaller market share in $t-1$ generally advertise less in absolute dollars in t than a firm with a bigger market share? Manufacturing facilities and product cost certainly are not a sufficient explanation in many industries, e.g., cigarettes, nor is geographical limitation. Differences in the cost of capital may be important. But the forces discussed here must have a central role.

the cost of changing one's behavior, habit formation, sentimental loyalty, or any of the related forces as they are described in the marketing literature. And these inertial forces operate probabilistically and can be modelled as a Markov process; the difference between a probability of repeat buying, and repeat buying for certain, does not affect the analysis, however. The custom (size) of the firm is taken to be exogenous in this analysis, as discussed earlier.

By market potential (D) is meant the function

$$D_t = f(P_t, A_t, B_t \dots)$$

where D_t = number of sales that will be made in period t apart from present custom Q_t , assuming one sale per customer

P_t = price

A_t = total advertising expenditure

B_t = product quality

and where other variables may be added if the decision-makers consider them relevant to a particular decision.

The analysis abstracts from all competitive interaction among firms, and focuses only on the shortest-run tactical choices. That is, the analysis will be an exercise in comparative statics (or perhaps comparative dynamics), examining a firm which can assume that its custom and its demand function with respect to price or advertising (i.e., its market potential) may be taken as given for the decision period, though the

potential and more especially the number of "loyal" customers will be varied to make the central point.

Consider a firm, F, that is now planning its operations for the coming period. The firm has tentatively chosen a price of P and an advertising budget of A. Assume that this combination of {P,A} is very close, as close as one wishes, to the profit-maximizing point for the firm as estimated by the firm's decision-maker(s).* Now let the

*This point may be thought of as an equilibrium position for the firm, according to Machlup's definition of "equilibrium, in economic analysis, as a constellation of selected interrelated variables so adjusted to one another that no inherent tendency to change prevails in the model which they constitute." (1958/1967, p. 54). I think it is better here to avoid the term "equilibrium" for the firm, however, both because it may be blurred with the notions of market equilibrium and general equilibrium which are not part of the analysis here, and also because of the general confusion surrounding the terms "equilibrium" and "disequilibrium" which Machlup dissects so effectively (1958/1967, pp. 43-72).

However, Machlup's model of a model, embodying the notion of equilibrium, does seem to fit the approach taken here:

"The following scheme illustrates the step-by-step working of a model; each step is described both in customary technical terms and in terms of catch-phrases in everyday language:

- Step 1. Initial position: "equilibrium," i.e., "Everything could go on as it is."
- Step 2. Disequilibrating Change: "new datum," i.e., "Something happens."
- Step 3. Adjusting Changes: "reactions," i.e., "Things must adjust themselves."
- Step 4. Final Position: "new equilibrium," i.e., "The situation calls for no further adjustments..."

"In a nutshell, we have here a mental experiment in which the first and last steps, the assumption of initial and final equilibria, are methodological devices to ensure that Step 2 is the sole cause and Step 3 contains the complete sequence of effects. The function of the initial equilibrium is to assure us that "nothing but 2" causes the changes under Step 3; the function of the final equilibrium is to assure us that "nothing but 3" is expected as an effect of the change under Step 2 (although the completeness" of the list of effects will always be merely relative to the set of variables included in the equilibrium)." (Machlup, 1958/1967, pp. 47-49)

decision-maker(s) consider reducing the firm's price an amount Δ to $(P-\Delta)$ or increasing its advertising an additional amount γ to make a total of $(A+\gamma)$. Assume that either small change would be marginally profitable if the market-potential function is D ; this function refers to customers who will not "automatically" buy from firm F at price P and advertising level A , and either change under consideration would bring one new customer. The expenditure γ equals the drop in revenue from the M customers that the firm would have at $\{P,A\}$ if it drops price to $(P-\Delta)$, together with the difference between P and $(P-\Delta)$ charged to the additional customer; this overall "loss" equals $(M+1)\Delta$, which just equals γ by assumption, by simple Dorfman-Steiner reasoning for a profit-maximizing point. The firm is therefore indifferent between the strategy of advertising $(A+\gamma)$ and the strategy of setting price $(P-\Delta)$, both of which are preferable to doing neither. The firm is also indifferent between these two options and no change at all. (We shall assume that it would not be profitable for the firm to both lower price to $P-\Delta$ and raise advertising to $A+\gamma$, and that any further drop in price or increase in advertising would not be profitable.)

To simplify, a zero cost of production is assumed; production with constant marginal cost clearly leads to the same result, however. In any case, production costs will be brought into the picture in the section on product quality.

The firm's choices with their present values (V) may be shown as follows, where the alternative is the superscript of V , the present market-potential function is the first subscript, and the term "no

contract" should be ignored for now: The period subscript in the control variables is omitted for convenience.

$$(1) \quad V_D^{A+\gamma}, \text{no contract} = PM + PD + P(1) - (A+\gamma)$$

where the first term on the r.h.s. represents the revenue obtained from the loyal customers; the second term is the revenue obtained from the customers that would be obtained with $\{P,A\}$; the third term is the revenue from the "additional" customers obtained by advertising $A+\gamma$ rather than A , along with P ; and the fourth term is the expenditure on advertising.

$$(2) \quad V_D^{P-\Delta}, \text{no contract} = (P-\Delta)M + (P-\Delta)D + (P-\Delta)(1) - A$$

$$(3) \quad V_D^{A+\gamma}, \text{no contract} = V_D^{P-\Delta}, \text{no contract}, \text{ which is the same as writing}$$

$$(4) \quad \gamma = (M+1)\Delta.*$$

*It is not the size of the potential market--that is, whether a particular set of control variables produces D or $D-1$ customers--that influences the choice of advertising or price reduction; the firm in this example is indifferent between the strategies at either market size, to a small approximation. This may be seen in the following profit calculations for the two strategies with $D-1$ uncommitted potential customers who will produce at $\{P,A\}$.

$$(5) \quad V_{D-1}^{A+\gamma}, \text{no contract} = PM + P(D-1) + P \left(1 \times \frac{D-1}{D}\right) - (A + \gamma)$$

$$(6) \quad V_{D-1}^{P-\Delta}, \text{no contract} = (P-\Delta)M + (P-\Delta)(D-1) + (P-\Delta) \left(1 \times \frac{D-1}{D}\right) - A$$

Subtraction of (6) from (5) using (4) shows that the difference between them is $\left(\frac{1}{D}\right)\Delta$, a very small number in comparison to the differences of order Δ we shall see when we alter the firm's custom.

Now consider that, for some exogenous reason, a person who had not previously been part of the potential market moves into the area and signs a contract with the firm. Or, alternatively, we might think of the change in putative circumstances as an upward revision by one customer in the decision-maker's estimate of the firm's potential sales, as a result of additional scanning of the market environment; this interpretation would seem particularly congenial to Austrians. That is, the firm's custom becomes "bigger" by one more customer. The firm will then still be indifferent between advertising $(A+\gamma)$ and advertising A . But if the firm lowers price to $(P-\Delta)$, it will now be in a considerably less profitable situation than remaining at $\{P,A\}$ or going to $\{P,A+\gamma\}$. This may be seen in the comparison of the two profit functions:

$$(7) \quad V_D^{A+\gamma}, \text{contract} = PM + PD + P(1) + P(1) - (A+\gamma)$$

$$(8) \quad V_D^{P-\Delta}, \text{contract} = (P-\Delta)M + (P-\Delta)D + (P-\Delta)1 + (P-\Delta) - A$$

Subtracting (8) from (7) shows that the advertising strategy now yields Δ greater profit.

This result can also be seen in the context of the Dorfman-Steiner theorem (1954). Their basic proposition is that at the profit-maximizing point the elasticity of demand with respect to price

$$\eta = \frac{P}{Q} \frac{dQ}{dP}$$

and the marginal value product of advertising

$$\mu = P \frac{dQ}{dA}$$

are equal to each other

$$\eta = \mu.$$

An increase in custom Q decreases η , but leaves μ unchanged. Dorfman and Steiner prove that when $\mu > \eta$, it pays to increase expenditure and price. But in this narrowly-defined case in which market potential D does not change (and the Q in dQ really is closer in meaning to D than to Q), the only cause of increased advertising is the price increase, which is a second-order difference; hence it is intuitively clear that the increase in advertising is "relatively" small compared to the indicated increase in price, in fact, nearly zero. (To show this rigorously would be a bit difficult, and would likely require complete specification of the market-potential function.)*

Please notice a crucial difference between this paper and that of Dorfman and Steiner: They draw no conclusions about the relative impacts on advertising, price change, and quality that will result from a change

*The entire analysis of this paper might be conceivably framed in elasticities of the sort that Dorfman and Steiner used, as a couple of readers have urged. But I believe that such a method would be less precise, and would obscure the main insight of this paper. For example, the price "elasticity" of loyal customers is--by definition--different than that of uncommitted persons. But the μ in the Dorfman-Steiner formulation would necessarily be some average of the two elasticities, masking the difference between them which is the heart of the analysis, because the Q in their formulation does not distinguish between the two sorts of persons.

To bring out the difference between committed and uncommitted persons would require an explicit demand formulation. Edward Rice has shown me how this would be done for a linear sales function of the sort $V = PM + D_1^A + D_2^P$, where D_1^A and D_1^P are the separate advertising and sales effects, i.e., where advertising shifts the demand function in a parallel fashion. Assume the firm is optimising at $\{P,A\}$. Now increasing M to $M+1$ leads to negative marginal revenue, and hence to higher advertising and higher price (the latter interpreted here as a lower propensity to cut price). A more realistic sales function would raise considerable difficulties in showing this phenomenon, however.

in the firm's size. In the context of the previous discussion, their theorem offers no guidance about whether a price rise or an advertising increase will be more likely as a firm's custom increases and $\mu > \eta$; this case will be discussed below.

It may be illuminating* to rewrite (4) as

$$(4a) \quad \frac{Y}{\Delta} = M + 1.$$

This suggests that the relative effectiveness of a price cut and additional advertising depend upon the size of the custom, M.

Loosening the implicit assumption that the quantity of advertising has no effect on presently loyal customers only strengthens the result obtained so far. This can be seen by assuming that the benefit of γ advertising in strengthening the attachment of present customers is worth ϕ . We can then find some new $\hat{\gamma}$ which (to a small approximation, which could be made more precise quite easily) is equal to $(\gamma - \phi)$, and hence $\hat{\gamma} = \Delta$. If we now add one customer to the custom, there will be some additional benefit from $\hat{\gamma}$ due to its effect on the additional (M+1)th customer, hence leaving advertising at least as attractive an alternative as it is with M customers, whereas the reduced benefits to Δ of adding the (M+1)th customer are not affected at all by this adjustment.

Now let us show that the basic proposition holds even if the additional customer comes from within the potential market, depleting that potential market of one of its potential customers rather than

*John Gould pointed this out to me.

coming from outside. We first notice that the reductions in customer-getting effectiveness of both γ and Δ are about the same near this profit-maximizing point: let us call the reduction e . Then $(\gamma + e)$ and $(\Delta + e)$ are the quantities needed to get one additional customer. And we may write, by analogy to (7) and (8)

$$(7a) \quad V_{D-1, \text{contract}}^{A+\gamma} = PM + P\left(\frac{D-1}{D}\right) + P(1) + P\left[1 \times \left(\frac{D-1}{D}\right)\right] - (A+\gamma+e) \quad \text{and}$$

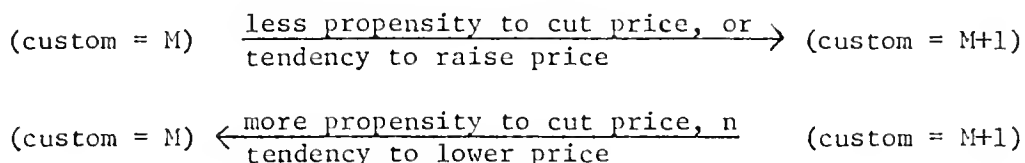
$$(8a) \quad V_{D-1, \text{contract}}^{P-\Delta} = (P-\Delta+e)M + (P-\Delta+e)\left(\frac{D-1}{D}\right) + (P-\Delta-e)(1) \\ + (P-\Delta-e)\left[1 \times \left(\frac{D-1}{D}\right)\right] - A$$

Subtracting (8a) from (7a) shows that the advertising strategy yields $(\Delta+e)\left[1 \times \left(\frac{D-1}{D}\right)\right]$ higher profit.*

To recapitulate we see that the attractiveness of an increase in advertising relative to a price reduction is affected by the firm's custom (by which we mean the number of customers bound to the firm by one force or another.) This corroborates the casual observation that the larger the firm, *ceteris paribus*, the greater the propensity to advertise. The underlying reason is that the more loyal customers that a firm has, the more it "loses" on these customers when it reduces price. In contrast, a change in the absolute number of uncommitted customers in the market need not influence the choice between advertising and price reduction, though one could undoubtedly create plausible response functions that would show the effect going in either direction (see Simon, 1970, Chapter 2, especially p. 55).

*This is almost $2N$ times the difference between (5) and (6), a point mentioned only to corroborate that (5) and (6) are roughly equal.

Please notice that after the addition of a customer to the firm's custom, there will again be some near-profit-optimizing combination of P and A, say P_1 and A_1 , where the firm is indifferent between using more advertising or a price cut to achieve one more customer, were it to decide to go after one more customer. If we now subtract one customer from the firm's custom, the firm will no longer be indifferent between increasing advertising and reducing price, by exactly the opposite logic as given above; it will now find it more profitable to reduce its price. That is, we see that adding a loyal (M+1)th customer leads to increased advertising and decreased propensity to cut price. There is then a new profit-maximizing point. If at that point, the process were reversed and the (M+1)th customer were lost, it would then be relatively more profitable to reduce price than to increase advertising relative to the profit-maximizing combination with M+1 customers. This logic would also apply to each point between M and M+1 customers, and hence we have proven that moving from the firm's equilibrium at M to the firm's equilibrium at M+1 reduces propensity to cut price relative to the increased-advertising alternative. This may be schematised as follows:



The analysis now comes close to meeting Machlup's earlier quoted description of an equilibrium analysis for the firm (though not for an analysis of market equilibrium or general equilibrium, of course). We examine the firm near its profit-maximizing equilibrium, apply the shock

of an additional customer, and see that in that neighborhood the result is an increased propensity to use advertising in comparison to a price reduction. We also see that when the firm settles down to its new equilibrium, a reversal of the shock would result in a decreased propensity to advertise relative to price reduction. From this it seems fair to include that the addition of a customer reduces the firm's propensity to cut price relative to increased advertising.

An obvious corollary of proposition 1 is that the smaller the firm's custom, the more likely it is to cut prices.

The proposition proven above, as well as all the other propositions in the paper, might be shown more elegantly by writing explicit sales-response functions with advertising, price (and later, product quality) and lagged sales as arguments, and then comparing the profit results under various assumptions. But there is a great variety of reasonable functions that could be written, few of them simple, and the analysis would surely be complicated mathematically. Even more important, the generality of the conclusion would be limited to the functions specified. The analysis given above refers to any functional forms, which is a considerable degree of generality. Hence the simple form of proof given above has advantages which I hope outweigh its mathematical inelegance.

Other Pricing Behavior

The analysis given above immediately leads to additional propositions. In this section we can deduce

Proposition 2: The larger the firm's custom, ceteris paribus, the more likely it is to raise price rather than to decrease advertising.

This proposition can be deduced by running in reverse the equations in proposition 1. It is consistent with the observation that "leaders" in price rises tend to be larger "dominant" firms (e.g., Scherer, 1970, pp. 164-166).

As to the choice between raising price and increasing advertising, this is really of a different nature than the choice between lowering price and raising advertising, because an increase in price reduces the number of customers whereas a rise in advertising increases the number of customers. This means that now we are faced with the complication that one of the price-rise alternatives affects both the number of loyal customers who will buy as well as the number of potential customers who will buy, whereas the advertising alternative affects only the latter.

The price-rise-versus-advertising-increase choice may be analysed as follows, in the manner of (1) and (2) and assuming that the increase in price to $(P+\Delta)$ loses ψ loyal customers and also loses ω of the customers it would get with $\{P,A\}$

$$(9) \quad V_{\text{no contract}}^{A+\gamma} = PM + PD + P(1) - (A+\gamma)$$

$$(10) \quad V_{\text{no contract}}^{P+\Delta} = (P+\Delta)(M-\psi) + P(D-\omega) - A$$

$$(11) \quad \text{Let } [P + (M-\psi) \Delta + (D-\omega) \Delta] = \gamma$$

so that the two alternatives are equal at first. Now add one customer by contract from outside the market

$$(12) \quad V_{\text{contract}}^{A+\gamma} = PM + PD + 2P - (A+\gamma)$$

$$(13) \quad V_{\text{contract}}^{P+\Delta} = (P+\Delta)(M-\psi) + P(D-\omega) + (P+\Delta) - A$$

Subtracting (13) from (12), and using (11) to substitute for γ , we find that the price-rise alternative has a present value higher by Δ than the advertising-increase alternative. And hence we see

Proposition 3: A price rise is relatively more attractive than an increase in advertising when the firm's custom is larger, ceteris paribus.

III. PRODUCT QUALITY AND PRICE CHANGES

Proposition 4: The larger a firm's custom, the less likely it should be to raise quality in preference to increasing advertising.

This proposition obviously follows from proposition 1 if we index quality by the cost of production, because the increase in quality must be provided to all customers, both new and loyal; and the larger the number of loyal customers, the less attractive is the quality increase to the firm, ceteris paribus.

Here we must bring the cost of production into the analysis. Let C be the production cost per unit, the same at all levels of production. A reduction in quality of α is defined as a reduction in production cost of α dollars; an illustration is a reduction in proof of liquor, a simple dilution with water equivalent to selling less of the product per quart sold, and an increase in quality is an increase in proof.

Let us compare an increase in quality of α percent to an increase in advertising γ , where $M\alpha = \gamma$, and where the resulting change in profit will be the same given the firm's custom.

$$(14) \quad V_{\text{no contract}}^{\Delta+\gamma} = PM - CM + PD - CD + P(1) - C(1) - (A+\gamma)$$

$$(15) \quad V_{\text{no contract}}^{C+\alpha} = PM - (C+\alpha)M + PD - (C+\alpha)D + P(1) - (C+\alpha)(1) - A$$

Assume $\gamma = (M+1)\alpha$ so that the two alternatives are equal in value.

Now let us consider what happens if the firm's custom increases by one person formerly outside the market who now signs a contract. Following (7) and (8)

$$(16) \quad V_{\text{contract}}^{A+\gamma} = PM - CM + PD - CD + 2P - 2C - (A+\gamma)$$

$$(17) \quad V_{\text{contract}}^{C+\alpha} = PM - (C+\alpha)M + PD - (C+\alpha)D + 2P - 2(C+\alpha) - A$$

Subtracting (17) from (16) leaves an α profit advantage with the advertising alternative, showing that the larger custom makes it relatively less attractive to increase quality as a device to increase profit when the firm has additional loyal customers.

A corollary of this proposition is that the smaller is a firm's custom, the more likely it is to increase quality as a business strategy, in comparison to increasing its advertising.

Proposition 5: The larger a firm's custom, the more likely it should be to lower quality in preference to decreasing advertising.

This proposition follows immediately from proposition 3. Propositions 3 and 4 could both be tested very neatly on the proof-changing behavior of liquor brands. The liquor market also would provide a good test because each firm owns many brands, and these propositions should predict for the brand but not for the firm as a whole.

RESEARCH AND DEVELOPMENT STRATEGIES

Research and development expenditures are not one strategy; rather, R&D encompasses a variety of business strategies. Among the important R&D strategies are: (a) R&D to reduce costs of the existing product; (b) R&D to increase the product's quality (say, for simplicity, with the same production cost), and (c) R&D to produce new products. The firm's custom should influence which of these strategies the firm should choose. Let us consider them one at a time.

Proposition 6: The larger a firm's custom, the more likely it will be to invest in R&D that will reduce production costs, rather than engage in an increase in advertising. Such R&D is like an increase in price, and the proof is identical to that given above for proposition 3.

Proposition 7: R&D to cut costs should also be relatively more desirable than an advertising increase or a price cut, the larger the firm's custom, by rather obvious and similar logic.

Proposition 8: R&D to increase quality should be relatively more likely if the firm's custom is relatively small.

The argument for proposition 8 is identical to that for proposition 3, a direct increase in quality, except that the argument for proposition 8 must be phrased in terms of the probability of discovering a quality-increasing development rather than a quality improvement for certain.

The analysis of R&D expenditures intended to produce new products is more complex than the analyses above. For new products the analysis must take into account both the effect of the new product upon sales of the old product (substitution) as well as the effect upon newly-attracted

customers. In a simplified case where the prices of the old and the new products are the same, the result may be viewed as the net number of new customers (the total number of customers attracted by the new product less the number of old-product customers who switch to the new product) and the analysis is then the same as for advertising versus a price cut (proposition 1) with the R&D similar to advertising. This would lead to

Proposition 9: The larger the firm's custom, the more attractive is R&D to increase the number of products, relative to a price cut.

DISCUSSION

Perhaps it would be helpful to discuss the main differences between the approach used in standard price theory and the method discussed here. These differences are all related to the present analysis taking as given the observed differences among firms in a market, especially differences in size. From this it follows that firms may rationally differ in the strategic choices they make, and the task of this paper is to understand those differences. In contrast, standard price-theoretic analysis does not assume (and perhaps does not even allow) such differences among firms, and makes no attempt to understand the effects of such differences.

Another key difference is the explicit inclusion of the effect of the firm's behavior in one period upon its market behavior in the next period, in contrast to comparative statics that excludes time-dependent effects. This inter-period effect arises because the choice of tactics in t influences the firm's custom in $t+1$, which then influences its choice of tactics in $t+1$. This multi-period effect is omitted from the usual industrial-organization analysis of markets; an example is

the timeless standard comparative-statics analysis of the "dominant" firm as a price leader (e.g. Scherer, pp. 164-166). This inter-period influence also must affect any attempt to derive a market equilibrium that begins with differences among firms. If there were to be no additional changes in the environment, some stability would surely eventuate, cybernetic theory assures us, though it is not clear whether or not the result would be identity among firms in characteristics and tactics. But a continuous flow of changes in the environment is a central feature of the reality being studied here, and I speculate that the inter-period connection implies that these environmental changes will translate into continuing differences among firms, to a degree that would not occur if inter-period interaction were not present.

SUMMARY AND CONCLUSIONS

The aim of this paper is to explain the connection between firm size and business strategy, one of the more important links between market structure and market behavior. The concept of market share is frequently adduced in literary discussion by writers on industrial organization, but it is seldom, if ever, defined rigorously or used in formal analysis. The concept used here to measure firm size is "custom," by which is meant the number of a firm's customers in period $t-1$ who will buy from the same firm in period $t=0$ if price is not changed. This concept best fits firms that do not sell homogeneous goods in narrowly-defined markets, but rather sell products that are physically differentiated and have a wide variety of partial substitutes.

The theory given in the paper predicts a set of propositions such as: (a) The larger a firm's custom, the more likely is a firm to choose additional advertising in preference to a price cut. (b) The larger the custom, the greater the propensity to raise price rather than to increase or decrease advertising or cut price. (c) The larger the custom, the greater the propensity to reduce quality rather than increase advertising or cut price. (d) The larger the custom, the less the propensity to develop cost-increasing quality improvements rather than lower price or increase advertising.

The fundament of the theory is that the larger the custom, *ceteris paribus*, the more "attached" customers who will pay less (more) if price is decreased (increased), and whose revenue could otherwise be counted on at the old price. In contrast, advertising does not affect revenue from the "attached" customers. Quality changes are similar in nature to price changes in this context. And the relationship of R&D activities to custom depends upon the type of discovery that is sought.

The propositions of the paper are all thoroughly testable in straightforward fashion.

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